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Composition Independent Thermometry in Gaseous Combustion Using Spectral Lineshape Information[1] DOMINIC ZELENAK, Graduate Student, North Carolina State University — Temperature is an important thermochemical property that holds the key to revealing several combustion phenomena such as pollutant formation, flame extinction, and heat release. In a practical combusting environment, the local composition is unknown, hindering the effectiveness of established non-intrusive thermometry techniques. This study aims to offset this limitation by developing laser thermometry techniques that do not require prior knowledge of the local composition. Multiple methods for obtaining temperature are demonstrated, which make use of the spectral line broadening of an absorbing species (Kr) seeded into the flow. These techniques involve extracting the Doppler broadening from the Voight profile and utilizing compositional scaling of collisional broadening and shift to determine temperature. Doppler broadening-temperature scaling of two photon Kr-PLIF is provided. Lean-premixed and diffusion jet flames of CH4 will serve as the test bed for experimentation, and validation of the two methods will be made using the corresponding temperature determined from Rayleigh scattering imaging with adiabatic mixing and unity Lewis number assumptions. A ratiometric dual lineshape thermometry method for turbulent flames will also be introduced.

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